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Two Cases of Accidental Infection of Man by  
an Attenuated (Vaccine) Strain of *Bacillus Anthracis*

by M. Karsch and P. Fritschner  
Archives de l'Institut d'Hygiène  
S, 75-77 (1947)

Observation 1.

M. K. D., a technician in the assessment service for microbial vaccines, requested medical examination because of a lesion on the index finger of his right hand which had the appearance of an early anthrax pustule. A microscopic examination of the serous exudate revealed the presence of B. anthracis.

The affected finger was slightly swollen, there was no effect on the nerves and the temperature was normal.

The serous exudate from the lesion was inoculated into broth, agar, and Veillon's medium. The following day the aerobic cultures were positive and presented the characteristic appearance of our attenuated strain, C5, which is utilized for the preparation of vaccine.

Etiology

Interrogation of the patient made it possible to establish the mode of infection. On 22 June 1946, prolonged repetition of the same motion while working had caused a bruise on the right index finger. On the 23rd of June a blister formed which opened on the 24th. M. K. D. removed the skin and lightly touched the wound with mercurochrome. The same day he assayed - over a period of several hours - an anthrax vaccine, and he admits to contaminating his fingers without cleaning them. By the 25th of June the appearance of the lesion disturbed him and we verified the presence of B. anthracis. Therefore, the incubation period could not have exceeded 24 hours.

Evolution

On the 28th of June (3rd day of illness) the lesion had a necrotic center surrounded by a purple zone. The finger was markedly swollen but not painful. Temperature was normal. The patient was placed under medical surveillance and, with his permission, treatment was limited to a dry dressing.

On the 29th of June (4th day of illness) the patient who was aware that he had anthrax became concerned, pretended that his arm bothered him and wanted to be treated. He was given 10 c.c. of Lugol's solution intravenously. On the 30th of June and the following days, the lesion remained circumscribed, the edema minimal, general state of health normal. Mercurochrome dressings were applied.

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On 2 July it was easily possible to detach with forceps the center of the necrotic tissue. On 15 July the lesion was well on the way to healing.

The total evolution had therefore lasted 15 days though the treatment, limited to a single injection of Lugol's solution could not have had a notable influence.

#### Observation 2

A., a laboratory boy responsible for holding animals in laboratory number 3, came for medical examination on 13 February 1946 because of a lesion on his face. He had a necrotic lesion, dry, depressed, about 3 millimeters in diameter, surrounded by an area of small vesicles in an early stage of formation.

Microscopic examination revealed the presence of B. anthracis and the cultures were identified in 24 hours as the attenuated strain, C5. This determination has been confirmed by inoculation of two guinea pigs and two rabbits with 0.1 c.c. of broth culture. The guinea pigs died in 3 days and the rabbits did not die.

#### Etiology

On the 11th of February the boy A. confirmed the presence of a small pimple above his left eye.

On the 10th and 11th of February he had handled the autopsied bodies of guinea pigs which had been infected with strain C5 in the titration of anthrax antiserum. It is very likely that he scratched his face before decontaminating himself.

#### Evolution

On 13 February the lesion showed the characteristics described above which allowed us to suspect anthrax. There was no edema nor fever. By 14 February we knew that he was infected with the attenuated strain and with the agreement of the patient decided to withhold treatment.

On 17 February (7th day of illness) the necrotic focus had attained a diameter of 8 millimeters and was surrounded by small vesicles and a slight zone of edema. The upper eyelid was painful. Though his temperature was normal, the patient requested treatment and was taken to the hospital.

The attending physician, disturbed because of the site of the lesion, injected the patient over a four day period with 160 c.c. of anthrax antiserum. On 26 February (15th day of illness) the lesion was completely healed. At no time did the patient have any fever or generalized symptoms.

On the other hand, on 27 February there were reactions from the serum which lasted until 2 March.

### Color Reaction of Strain 1946 Antigen

All strains have uniformly reacted in 24 hours between the cultural characteristics of virulent and avirulent strains of 1946.

Colonies of strains obtained from malignant pustules of man or those obtained from the skin of man or from the mouth without bleeding the medium. They are small, fluffy filaments also noted on the surface of the medium in the culture tube.

On agar the colonies are whitish, convex, have irregular borders or are cloudy, and are separated with difficulty.

In enriched mediums, especially those that are adapted to rapid multiplication, most in broth in small tubes distributed throughout the medium and consequently the culture has a cloudy appearance. After 12 hours, the flakes settle to the bottom of the tube yielding a white mass above which is the clear medium.

On agar, the colonies are flat, whitish and are separated easily.

Inoculation represents a less rapid and less certain method of differentiation.

The guinea pig should not be used. L. P. Delpy and H. Kaveh (1946) have shown that the 100% fatal dose of the attenuated strain is 10 spores.

The rabbit can yield fairly rapid indications. If at least 5 rabbits are inoculated with 0.5 c.c. of 24 hour culture, an attenuated strain should not kill more than one of the five animals while a virulent strain would be 100% fatal.

### Comparison of Pathogenesis in Man

The classical descriptions of malignant pustule in man or those which have been presented by L. P. Delpy and H. Kaveh (1946) indicate that virulent strains always cause serious local lesions with spreading edema and general reactions which are often very disturbing.

The overall mortality in Iran has been estimated as 4.5% and in serious cases requiring hospitalization, 11%.

Treatment with specific serum or with Inulin solution is almost helpful. However, if therapy is not initiated until the pustule is well developed, the number of injections of therapeutic agent must be increased and recovery is always slow.

The two cases we have presented show that the attenuated strain results in a much less serious disease.

In the first case (pustule of the finger) treatment was limited to a single injection of 10 c.c. of Inrol's solution which evidently had only a negligible effect on the evolution of the disease. Despite the fact that the inoculation could have been heavy since the denuded skin was contaminated over an area of about 1 square centimeter, the local lesion was very benign and there was no general reaction.

In the second case, the site of the pustule close to the eye might have been expected to result in extensive spreading edema and very serious lesions (see L. P. Delpy and M. Kawch 1946, photographs 5, 8, 10). Instead, on the seventh day of disease i.e., at a time when the infection would be expected to be most severe, there was only a small necrotic focus, a very limited edema and no generalized reaction.

It is certain that in these cases the serum was more detrimental than helpful since it caused reactions more disagreeable than the illness being treated.

#### Conclusions

1. Laboratory personnel who prepare anthrax spore vaccines as well as individuals who use such products are exposed to infection if the vaccine is placed in contact with a wound or bruise.
2. The resulting infection ~~such as we have observed~~ in two cases is quite benign with formation of only a small necrotic focus at the site of inoculation, very limited edema, no general reaction - recovery in two weeks.

The treatment which had been initiated tardily and without any real necessity would not have resulted in such a rapid recovery if the infection had been caused by a virulent strain.

3. In the country where anthrax in animals is common, certain categories of workers are continually exposed to this infection. The malignant pustules which result are always serious. If early treatment is not instituted they develop extensive lesions and sometimes die.

The observations that we have just presented allow one to envisage the possibility of prophylactic vaccination of individuals who may be exposed to this disease and particularly those who may not have the benefit of early medical intervention.

It would probably be easy to select avirulent vaccine strains and a mode of inoculation that would result in mild vaccination reactions but nonetheless would confer a solid immunity.

#### Bibliography

- L. P. Delpy and M. Kawch - 1946 - Archives de l'Institut d'Hygiène 4, 3.